Egyptian Journal of Ear, Nose, Throat and Allied Sciences (2015) **16**, 243–245

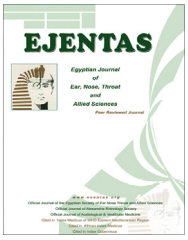
HOSTED BY

ELSEVIER

Egyptian Society of Ear, Nose, Throat and Allied Sciences

Egyptian Journal of Ear, Nose, Throat and Allied Sciences

www.ejentas.com



ORIGINAL ARTICLE

Intra-tympanic corticosteroid for the treatment of Primary immune-mediated sensorineural hearing loss

Mohamed A. Hamid [a], **Ossama A. Hamid** [b], **Somia Tawfik** [b], **Sherif K. Mohamed** [b,*], **Ihab Kamal** [b]

[a] *Cleveland Hearing and Balance Centre, USA*
[b] *Ain-Shams University, Egypt*

Received 8 June 2015; accepted 7 August 2015

KEYWORDS

Intra-tympanic;
Corticosteroid;
Immune-mediated;
Sensorineural;
Hearing;
Loss

Abstract *Introduction:* Development of sensorineural hearing loss [SNHL] leads to severe handicap that affects patient's job, home and life. Therefore, otologists should diagnose potentially treatable disorders to improve and/or even stabilize hearing.

Aim of work: Evaluation of intra-tympanic corticosteroids for the treatment of different types of SNHL.

Subjects and methods: Intra-tympanic injection of steroid under local anesthesia of 51 patients suffering from immune-mediated SNHL. Audiological evaluation was done pre & post-injection.

Results: Hearing improvement of 23.41 dB by pure tone audiometry occurred in 43.2% of patients. Speech discrimination scores had improved by 30.1% in 78.4% of patients.

Conclusion: Intra-tympanic steroid injection is a safe and promising tool for the treatment of immune-mediated SNHL.

1. Introduction

Rapidly progressive deafness is a frightening condition as most affected individuals have normal hearing prior to the onset of hearing instability. It should be considered as an medical emergency for which definitive diagnosis and treatment are still largely vague. The single most important aspect of this disease, from a physician standpoint, is the recognition that deafness is potentially treatable, Harris et al.[4]

Recent clinical and laboratory evidence increasingly indicates that most of the acquired SNHL are immune-mediated diseases. These include:

- Idiopathic sudden sensorineural hearing loss (ISSNHL)
- Idiopathic progressive bilateral sensorineural hearing loss (IPBSNHL)
- Meniere's disease.

* Corresponding author.
E-mail addresses: hamidma@clevelandhearingbalance.com (M.A. Hamid), ossamahamid@gmail.com (O.A. Hamid), dr_somaia@hotmail.com (S. Tawfik), sheriflina@gmail.com (S.K. Mohamed), ehabkamalhakim@hotmail.com (I. Kamal).

Peer review under responsibility of Egyptian Society of Ear, Nose, Throat and Allied Sciences.

http://dx.doi.org/10.1016/j.ejenta.2015.08.002

Systemic corticosteroids have shown good effects in the treatment of SNHL hearing loss especially the immune mediated group, McCabe.[8]

The systemic use is usually associated with systemic complications especially in high doses e.g. diabetes, GIT bleeding, osteoporosis, hypertension or avascular necrosis of the head of the femur especially if patients are predisposed or have a milder form of the disease, Shea.[13]

Inner ear glucocorticoid receptors have been identified in different animal models; Pitovski et al.[11] Rarey and Curtis[12] had substantiated this finding in human cadaveric temporal bones. They identified receptors in both the cochlear and vestibular tissues; with the highest concentration found in the spiral ligament.

There is good experimental evidence that dexamethasone readily passes through the round window membrane and that it can be found in the lower and upper turns of the cochlea as well as the vestibule in large quantities after being left against the round window membrane for 3 h; Nomura.[9] Parnes et al.[10] found that intra-tympanic administration of steroids resulted in significantly higher inner ear concentration compared with systemic administration.

2. Aim of work

Evaluation of intra-tympanic corticosteroids for the treatment of Primary immune-mediated SNHL, as intra-tympanic application of drugs is an attractive and possibly efficacious method of treatment that avoids systemic toxicities.

3. Subjects and methods

Fifty-one patients suffering from ISSNHL, IPBSNHL or Meniere's diseases were enrolled in our study done at Ain Shams University, Cairo, Egypt. Their mean age was 43.56 years and their male: female ratio was 20:31 (children were not included in the study). These were divided into three groups; Twenty-seven patients were suffering from IPBSNHL, 18 were suffering from Meniere's disease and 6 patients were suffering from ISSNHL.

Their diagnosis was confirmed through:

- Clinical picture: to exclude other ENT problems and to select the patient groups enrolled.
- Basic audiological evaluation: including pure tone audiometry (PTA) & speech discrimination score (SDS) tests to determine baseline patients' values before the start of treatment.
- Advanced evaluation of selected patients from previous basic evaluation to be submitted to Electrocochleography (ECochG), to confirm Meniere's disease, &/or MRI to exclude retro-cochlear lesions. Tympanometry, oto-acoustic emissions (OAE) & auditory brain stem response (ABR) tests were done on tests for auto-immune ear diseases.

Pre-treatment counseling for possible benefits and side effects of the procedure was performed for all patients.

Intra-tympanic 12 mg dexamethasone (0.5 ml of 24 mg/ml) was injected, so as to diffuse through the round window niche to the inner ear, after local anesthesia by glycerin phenol 20%. The ear remains up for 30 min. A small opening in the anterior part of the drum was made to allow air to escape while injecting the drug. The procedure was repeated every third day for three times.

Post-treatment audiological evaluation using PTA & SDS were done in all patients after one week after the completion of the three injections.

All data were tabulated and statistically analyzed using SPSS software for windows. Mean values of different parameters were compared using analysis of variance (ANOVA) or Student *t*-test (paired and unpaired). *P*-values <0.05 were considered significant. Pearson and Spearman's correlation co-efficient were also used.

4. Results

Intra-tympanic corticosteroid therapy for the treatment of SNHL was done for 51 patients; with no significant difference in the age or sex between the three groups.

PTA results after intra-tympanic dexamethasone showed improvement in 22 patients (43.13%) while SDS results showed improvement in 40 patients (78.4%).

Improved PTA & SDS results obtained for each patient group and for the total average threshold for the whole patients after intra-tympanic injection were compared and statistically analyzed. It revealed a highly significant improvement (*P*-value <0.001); as shown in Tables 1 and 2 respectively.

The correlation between SDS and PTA results in the three patient groups as a whole and in both IPBSNHL & Meniere's disease groups proved to be significant. The ISSNHL group results showed a non-significant correlation; as shown in Table 3.

Table 1 PTA results before & after treatment.

Group	Number	Before	After	*P*-value
ISSNHL	3	43.33 dB	66.66 dB	0.005
Meniere's	7	64.00 dB	82.54 dB	0.001
IPBSNHL	12	53.33 dB	79.16 dB	0.001
Total	22	58.09 dB	78.41 dB	0.001

Table 2 SDS results before & after treatment.

Group	Number	Before (%)	After (%)	*P*-value
ISSNHL	4	32.00	65.25	0.001
Meniere's	14	55.57	88.14	0.001
IPBSNHL	22	48.09	75.27	0.001
Total	40	49.10	79.02	0.001

Table 3 SDS & PTA correlation results.

Group	Correlation coefficient	*P* value
ISSNHL	0.008	>0.05
Meniere's	0.513*	<0.05
IPBSNHL	0.402*	<0.05
Total	0.356*	<0.05

* Significant correlation.

Table 4 PTA & SDS correlation coefficient with disease duration.

	Correlation coefficient	*P* value
PTA	−0.063	> 0.05
SDS	−0.094	> 0.05

Despite the correlation between SDS and PTA results in the three patient groups with disease duration proved to be negative, but with statistically non-significant correlation; as shown in Table 4.

5. Discussion

Intra-tympanic steroid injection is an easy and effective outpatient procedure for the treatment of Meniere's disease, ISSNHL and IPBSNHL to avoid the side effects of systemic corticosteroids.

Our study is in agreement with the protocol of Hamid.[3] In his four years experience with IT steroid injection, utilizing the same technique we adopted in our study, he reported 90% SDS recovery.

Li et al.[6] demonstrated that intra-tympanic dexamethasone perfusion by an external electronic pump with gelatin sponge placement in a round window niche is an efficacious and safe method for the treatment of ISSNHL, showing superiority to simple injection through the drum. This is in contrast to the results we obtained utilizing the injection method that showed a significant improvement in our results that is nearly similar to the better results obtained by their pump technique.

Garavello et al.[2] concluded that Intra-tympanic steroid therapy seems to confer a certain degree of benefit as salvage but not as a primary treatment of sudden deafness. This contradicts our results that proved IT steroid therapy as an effective primary therapy probably because of inclusion criteria utilized in their meta-analysis study.

The mean PTA demonstrated a significant therapeutic action of the short-duration intra-tympanic steroid therapy on moderate ISSNHL, with a flat audiogram shape, compared to the natural course of the disease and the placebo effect at that time point; Filipo et al.[1]

Intra-tympanic treatment of ISSHL may be a preferable choice as primary treatment option, since it can be performed in outpatient settings, with no serious side effects and complication rate; Ljiljana et al.[7]

Ilker et al.[5] reported that intra-tympanic steroid injections could be used safely and successfully in patients who do not respond to conventional intravenous treatment. It can also be applied as the treatment of choice in ISHL, especially in patients who have contraindications to systemic treatment with corticosteroids. This, in concordance with our study, demonstrates the efficacy of intra-tympanic steroid therapy in cases of ISSHL.

6. Conclusion

The advantages of IT steroid therapy are being an office based procedure performed under local anesthesia, it is less invasive, cost-effective, with no/minimal side effects and could be started immediately, make it a superior tool in the treatment of immune-mediated SNHL.

Statistically significant results shown in our study, proves its efficacy and safety over the use of systemic steroids.

Conflict of interest

We have no conflict of interest to declare.

References

1. Filipo R, Attanasio G, Russo FY, Viccaro M, Mancini P, Covelli E. Intratympanic steroid therapy in moderate sudden hearing loss: a randomized, triple-blind, placebo-controlled trial. *Laryngoscope*. 2013;123(3):774–778.
2. Garavello W, Galluzzi F, Gaini RM, Zanetti D. Intratympanic steroid treatment for sudden deafness: a meta-analysis of randomized controlled trials. *Otol Neurotol*. 2012;33(5):724–729.
3. Hamid MA. Intratympanic dexamethasone perfusion for Meniere's disease. Abstract presented at the 36th American Neurotology Society meeting, Palm Desert, CA; April 2001.
4. Harris JP, Moscicki RA, Hughes GB. Immunologic disorders of the inner ear. 2nd ed. In: Hughes GB, Pensak NL, editors. *Clinical Otology*. New York: Thieme Medical Publishers; 1997:381–391.
5. Akyildiz Ilker, Bayazit Yildirim A, Ceylan Alper, et al. Use of intratympanic dexamethasone as a salvage treatment in idiopathic sudden hearing loss. *Int Adv Otol*. 2010;6(1):25–28.
6. Li L, Ren J, Yin T, Liu W. Intratympanic dexamethasone perfusion versus injection for treatment of refractory sudden sensorineural hearing loss. *Eur Arch Otorhinolaryngol*. 2013;270(3):861–867.
7. Cvorovic Ljiljana, Strbac Mile, Jovanovic Milan B, Milutinovic Katarina, Stankovic Katarina, Djeric Dragoslava. Intratympanic steroid treatment as a primary therapy in idiopathic sudden sensorineural hearing loss. *Int Adv Otol*. 2009;5(3):334–339.
8. McCabe BF. Autoimmune sensori-neural hearing loss. *Ann Otol Rhinol Laryngol*. 1979;88:585–589.
9. Nomura Y. Ontological significance of the round window. *Adv Otorhinolaryngol*. 1984;33:63–72.
10. Parnes LS, Sun A, Freeman DJ. Corticosteroid pharmacokinetics in the inner ear fluids: an anatomical study followed by clinical application. *Laryngoscope*. 1999;109:1–17.
11. Pitovski DZ, Drescher MJ, Drescher DG. Glucocorticoids receptors in the mammalian inner ear. *Hear Res*. 1994;77:216–220.
12. Rarey KE, Curtis LM. Receptors for glucocorticoids in the human inner ear. *Otolaryngol Head Neck Surg*. 1996;115:38–41.
13. Shea JJ. Streptomycin perfusion of the labyrinth through the round window plus intravenous streptomycin. *Otolaryngol Clin Am*. 1994;27:317–324.